

ABSTRACT

The present invention provides drilling systems for drilling wellbores. The drilling system includes an umbilical that passes through a wellhead and carries a drill bit. A drilling fluid system supplies drilling fluid into an annulus (supply line) between the umbilical and the wellbore, which discharges at the drill bit bottom and returns to the wellhead through the umbilical (return line) carrying the drill cuttings. A fluid circulation device, such as a turbine or centrifugal pump, is operated in the return line to provide the primary motive force for circulating drilling fluid through a fluid circuit formed by the supply line and return line.

5 Optionally, a secondary fluid circulation device in fluid communication with the return line can cooperate with the fluid circulation device to circulate drilling fluid and/or a near bit fluid circulation device can be used to provide localized flow control or suction pressure to improve bit cleaning.

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